



CIO Special

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Smart Mobility: transportation reinvented

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Key take aways

- The smart mobility concept calls for a transformation of the entire transportation structure.
- Key concepts include electromobility, connectivity and shared mobility. Investment approaches might be via manufacturers, component suppliers and infrastructure and connectivity provision.
- Smart mobility will have multiple implications for many different key investment themes, not just 5G, AI and ESG in general.

01 Introduction

There is now broad public acceptance that actions need to be taken to tackle climate, not only among so-called millennials but also other age cohorts.

In a world of increasing urbanization and congestion, the issues of air pollution and congestion are also becoming even more acute. Conventional cars and trucks are significant contributors to pollution via the CO₂ NO_x, SO_x and particulates they emit.

But this is only problem with existing transport systems. All adding to economic costs. According to the World Health Organization, congestion alone can impact national GDP by 2-5% due to wasted time, additional fuel consumption and the increased costs of doing business.

Transportation systems therefore need to adapt. We can already see evidence of this in the global automotive industry as new technologies and consumers' changing habits and preferences challenge existing business models. Sales of electric vehicles are already booming and EVs could outsell their fossil-fuelled counterparts before 2040. Government policy on taxation and subsidies is playing a part here too.

Smart mobility concerns much more than the autos sector, however. One way to approach the topic is by considering the three issues of electromobility (electric-powered vehicles), connectivity (which would include autonomous driving solutions) and shared mobility. As we discuss in this report, these trends have major implications for many other sectors and how we live in general.

Smart mobility does not consist of a single solution, but is rather a complex mix of products, projects and services. Some key principles of smart mobility would include clean technology, safety, efficiency, integration, affordability, social benefits and flexibility.



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02 Electromobility: drivers and advantages

Regulation, costs, efficiency and carbon footprint reduction are key drivers of electromobility, but there are other factors such as the rollout of the charging infrastructure and new electric vehicles.

Regulation in virtually every major developed and developing market is becoming a major tailwind for EV production. We are increasingly seeing governments at city, state and national levels setting ambitious targets regarding the reduction of carbon emissions.

The **costs** of manufacturing electric vehicles (EV) are dropping faster than initially expected. In 2010 the cost of EV batteries was USD 1,200 per kilowatt hour (kWh), however there are now automotive industry predictions that batteries can be produced for less than USD 100 per kWh.

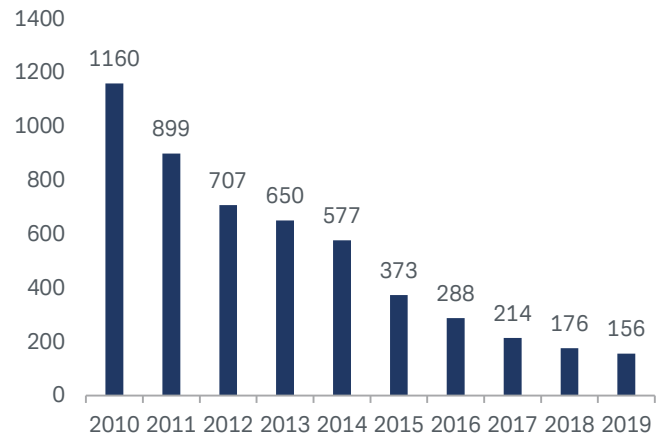
The **simplicity** of EV design versus traditional car models will also bring down manufacturing costs. An EV has fewer moving parts than a traditional car – less than 1 moving part for every 10 in a traditional car. This makes factory assembly faster and owner maintenance easier.

Another advantage of an electric motor is **energy efficiency**. An electric vehicle consumes roughly one-third of the energy of its fuel-driven counterpart when travelling 100 km, for example. In cities, the relative efficiency of EVs is even greater given low driving speeds and frequent braking.

Carbon emissions during the manufacturing of both EVs and conventional cars are dependent on the electricity mix of the

factories involved. This mix in most factories still contains fossil fuels like coal and natural gas. In the future, facilities that use renewable power will have a much smaller carbon footprint. During the use stage, an EV's carbon footprint depends on the mix of fuel used to generate its electricity. The higher the share of fossil fuel, the worse the footprint.

Figure 2: Battery pack price (USD/KWH)



Source: Bloomberg, Lithium-ion battery price survey result. Data as of 2020.

03 Connectivity: many different dimensions

Interconnectedness of all transportation and road users in a city-wide communication infrastructure offers the potential to significantly improve the capabilities of streets and traffic management centres. Software platforms integrate new "floating data" sources including smartphones and connected vehicles, supplementing or replacing conventional data sources such as roadside sensors.

Cities need to ensure that their technological infrastructure keeps pace with the demands of the big data era. A robust and connected telecommunications network is critical for AV and EV market growth. The car and its EV and AV counterparts are just one part of a bigger revolution in mobility. They are a very visible example of how cities will use sensors, the internet of things (IoT), and big data to improve the quality of life and reduce negative impacts on the environment.

The interaction that new vehicles will have with external objects and infrastructure will help transform urban mobility. There are many different types of vehicle connectivity: Vehicle to Pedestrian; Vehicle to Vehicle; Vehicle to Devices; Vehicle to Home (for extra power needs); Vehicle to Network; Vehicle to Grid (to return stored electricity at peak times); Vehicle to infrastructure (to learn about traffic congestion, road conditions, parking spots and other information).

Today's most advanced cars already have more than 100 sensors onboard, generating several gigabytes of data per hour. Comprehensive collection and analysis of data will enable traffic to flow more smoothly, reducing congestion and accidents in urban areas. The integration of city network data, for example provided by the cameras installed on traffic lights, will help optimize traffic flows.

Figure 1: Country commitments on phase out of ICEs (Internal Combustion Engines)

Country	Date	Vehicle
Norway	2025	Passenger Cars, Light Commercial Vehicles
Netherlands	2025	Urban Buses
Netherlands	2030	Passenger Cars
Denmark	2030	Passenger Cars
Iceland	2030	Passenger Cars
Ireland	2030	Passenger Cars
Slovenia	2030	Passenger Cars, Light Commercial Vehicles
Sweden	2030	Passenger Cars
United Kingdom	2030	Passenger Cars, Light Commercial Vehicles
Scotland	2032	Passenger Cars, Light Commercial Vehicles
France	2040	Passenger Cars, Light Commercial Vehicles
Spain	2040	Passenger Cars, Light Commercial Vehicles
Germany	2050	Passenger Cars
USA/California	2035	Passenger Cars, Light Commercial Vehicles
Colombia	2035	Public Transport
Canada	2040	Passenger Cars, Light Commercial Vehicles
Israel	2030	Passenger Cars
China	2030	Passenger Cars

Source: Blackrock. Data as of April 2021.



This dependence on data means that **5G networks** will be the main pillar for the development of connected mobility by providing the lower latency, better reliability and higher throughput to accommodate faster vehicle speeds and increased data demands. The EU's 5G Cities trials are looking at connected mobility and transit systems and moving to other public infrastructure services like lighting, health service initiatives or pollution reduction. Spectrum auctions in the U.S. to be followed by infrastructure deployments that will serve new mobility applications and provide additional tailwinds.

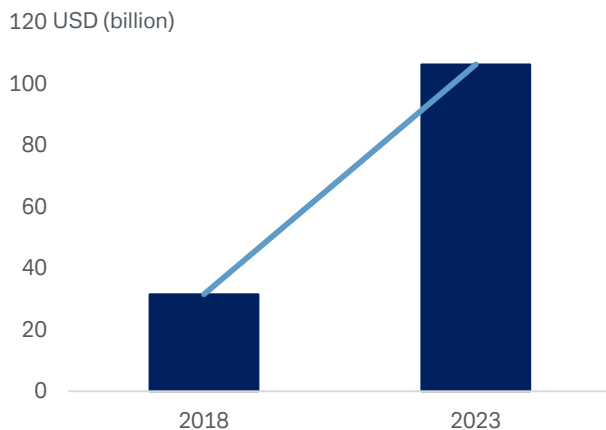
Autonomous driving solutions

Making fully automated vehicles a reality is one of the most ambitious undertakings in the history of the automotive industry.

The autonomous vehicle industry is growing exponentially, and some forecasts suggest that the market could be worth over USD 65 billion by 2027.

However, numerous technological, regulatory and legal hurdles still need to be cleared before autonomous vehicles can operate on a large scale.

Figure 3: Global revenue forecast of the automotive IoT market



Source: Netscribes. Data as of August 2021.

04 Shared mobility: major potential

Shared transport systems include car sharing, two-wheel sharing, ride-sharing or lift-sharing (carpools), real-time ridesharing, slugging (casual carpooling), community buses and vans, demand responsive transit (DRT), paratransit (unscheduled community services), a range of taxi projects and even hitchhiking and its numerous variants. The expansion of those, and other mobility solutions, including urban air mobility, is changing how we travel. Individuals now have many cost-effective and convenient alternatives to vehicle ownership, and their options will continue to grow over the next decade.

Revenues for the global automotive industry are forecast by one source to almost double by 2030, to USD 6.6 trillion.² Shared mobility services may drive about half of this increase.

The question is who will capture most of this expected growth. Some car manufacturers have already positioned themselves either by operating their own services (or by partnering with other operators).

According to McKinsey, the shared mobility market now exceeds USD 60 billion in value across the three largest markets: China, Europe, and the United States.¹ The future may bring stronger growth if robotaxis and shuttles become more common and urban air mobility moves past the pilot stage. With this momentum, they expect the annual growth rate for shared-mobility solutions to exceed 20 percent through 2030.

While shared mobility is a recent trend, it has quickly shifted consumer preferences away from car ownership toward alternative forms of transportation, making it an extremely disruptive force. Many of the associated changes will be positive, since the growth of shared mobility will open up new opportunities for multiple companies, including automakers, suppliers, technology businesses, and aerospace experts. Investment approaches.

05 Investment approaches

There are various ways to approach the smart mobility theme. Four are suggested below:

Manufacturers

- Electric vehicle manufacturers
- Suppliers of electric powertrains, electric motors, image sensing and data transmission, autonomous driving
- Production equipment and software for simulation and virtual prototyping

Component suppliers

- Producers of lithium-ion batteries, power electronic components for electric powertrain and battery charging, sensors and actuators, efficient lighting, lightweight materials

Infrastructure

- Electrical grid infrastructure (backbone and the distribution network)
- Electric chargers, including commercial chargers and fast charging stations
- Energy management systems integrating green power generation with electric vehicle charging, vehicle-to-grid services

Connectivity

- Software and electronics for digital cockpits, infotainment & driver information
- Connectivity services, vehicle-to-vehicle communication
- Advanced driver assistance systems (ADAS) including artificial intelligence (AI) based self-driving platforms and Autonomous Driving Systems (ADS)



06 Conclusion

Smart mobility should offer considerable investment opportunities, given the scale of the task. Major investment will have to be made in the electrical grid and the distribution network and rolling out the charging infrastructure. Cross industry alliances are possible (e.g., between energy companies, automakers, utilities and grid service providers) to develop EV support infrastructure.

There may apparently be some obvious winners (e.g., suppliers of sensors and connectivity-related systems) and component manufacturers focused solely on supplying parts for internal combustion engines will need to rethink their business models as electric vehicles make inroads into the car and truck markets.

But to evaluate the full impact smart mobility we need to look beyond the impact of shared mobility and vehicle connectivity on broader issues such as driving and parking conditions, journey

times, stress and accident rates. We can already see progress on the latter due to the implementation of safety features and systems.

There is still much debate as to how smart mobility will impact urban planning. One scenario would see city congestion decreasing and with it, the need for multiple traffic lanes. Space saved could be used for housing, green spaces or other functions.

But, alternatively, the convenience, cost, comfort and efficiency of an automated world could actually boost demand for vehicles on the road – which may need to be alleviated by fare-pricing regimes that charge premiums for peak-time deliveries and travel

Another spill-over effect is likely to be that the rapid ramp up in demand for cobalt and lithium for battery production.

In all, smart mobility will have implications for many of our other key investment themes – 5G fast forward, resource stewardship, artificial intelligence, cyber security, the blue economy (via mineral extraction) and ESG in general.



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Glossary

AV stands for Autonomous Vehicle.

Carbon emission is the release of carbon into the atmosphere.

EV stands for Electric Vehicle.

Fossil fuels include coal, petroleum, natural gas, oil shales, tar sands, and heavy oils.

A **lithium-ion battery** or **Li-ion battery** is a type of rechargeable battery.

The **MSCI World Index** is a broad equity index and captures large- and mid-cap companies across 23 developed countries.

OEM are Original Equipment Manufacturer who make systems or components that are used in another company's end product.

Powertrain refers to the set of components that generate the power required to move the vehicle and deliver it to the wheels.

USD is the currency code for the U.S. Dollar.



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